CAM

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Exhaust

TEAMWORK

THE scene is a workshop in a Canadian camp. Rows of army vehicles are nosed in along one side of the building and numerous coveralled figures are performing the countless maintenance jobs that are the business of an M.T. Workshop.

Second from the end, stands a mechanic who has been working on the differential of a heavy 6x6. At the moment he is just standing—looking very thoughtfully at the partially disassembled rear housing.

Someone comes up to us and says "Look at Smith down there. He's been standing around for over an hour now, scratching his head and wondering what to do with that rear housing set-up. He was sent up here from a training centre to help me and now he's waiting for me to come and do the the job for him"

The soldier in question was still hovering helplessly near the rear of the vehicle—saving his face. He wasn't going to call for help in case someone accused him of ignorance. And the N.C.O. wouldn't volunteer to help.

Stalemate. Much needed repairs to a truck were not getting done and no one was learning, or benefiting in the least.

A senseless thing when you think of it—yet a queer custom that is being carried on day after day.

So this turns into a sermon on "know-hows" and "don't know-hows"

If you don't know how—ask a question. That's the simplest and most intelligent way to learn.

If you do know how—share your knowledge. Remember there are a lot of things *you* don't know.

Let's get rid of an old and foolish custom right now—and realize that the other fellow isn't a competitor—but a member of the same team.

CAM

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FAREWELL MY LOVELY

I see by the new Sears Roebuck catalog that it is still possible to buy an axle for a 1909 Model T Ford, but I am not deceived. The great days have faded, the end is in sight. The last Model T was built in 1927.

It was the miracle God had wrought. Mechanically uncanny, it was like nothing that had ever come to the world before. As a vehicle, it was hard-working, common-place, heroic and it often seemed to transmit those qualities to those who rode in it.

The Model T was distinguished from all other cars by the fact that its transmission was of a type known as planetary—which was half metaphysics, half sheer friction. Because of the peculiar nature of this planetary element, there was always, in Model T, a certain dull affinity between engine and wheels, and even when the car was in neutral, it trembled with a deep imperative and tended to inch forward.

In its palmy days the Model T could take off faster than anything on the road. The reason was simple. To get under way, you simply hooked the third finger of the right hand around a lever on the steering column, pulled down hard, and shoved your left foot forcibly against the low-speed pedal. These were simple, positive motions; the car responded by lunging forward with a roar. After a few seconds of this turmoil, you took your toe off the pedal, eased up a mite on the throttle, and the car, possessed of only two forward speeds, catapulted directly into high with a series of jerks and was off on its glorious errand.

The driver of the old Model T was a man enthroned. The car, with top up, stood seven feet high. The driver sat on top of the gas tank, and when he wanted gasoline, he alighted, along with everything else in the front seat. The seat was pulled off, the metal cap unscrewed, and a wooden stick thrust down to sound the liquid in the well. Refueling was more of a social function then—the driver had to unbend, whether he wanted to or not. Directly in front of the driver was the windshield—high, uncompromisingly erect. Nobody talked about air resistance, and the four cylinders pushed the car through the atmosphere with a simple disregard of physical law.

There was this about a Model T: the purchaser never regarded his purchase as a complete, finished product. When you bought a Ford, you had a start—a vibrant, spirited framework to which could be screwed a limitless assortment of decorative and functional hardware. A flour-

ishing industry grew up out of correcting Model T's rare deficiencies and combating its fascinating diseases. You bought a radiator compound to stop leaks, a clamp-on dash light, a sun visor, and a fanbelt guide to keep the belt from slipping off the pulley. Persons of a suspicious turn of mind bought a rear-view mirror; but most Model T owners weren't worried by what was coming from behind because they would soon enough see it out in front. They rode in a state of cheerful catalepsy.

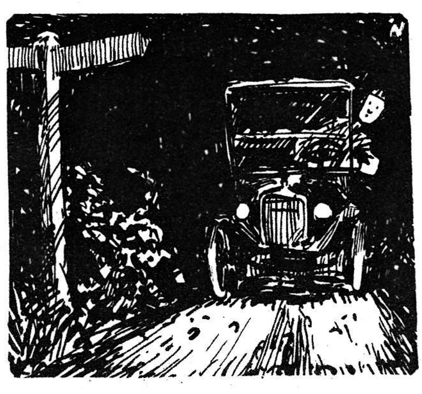
After the car was about a year old steps were taken to check the alarming disintegration. A set of anti-rattlers was a popular panacea. You hooked them onto the gas and spark rods, the brake pull rod, and the steering rod connections.

During my association with Model T's, self-starters were not a prevalent accessory. Your car came equipped with a crank, and the first thing you learned was how to GET RESULTS. The trick was to leave the ignition switch off, proceed to the animal's head, pull the choke (a little wire protruding through the radiator), and give the crank two or three nonchalant upward lifts. Then whistling as though thinking about something else, you would saunter back to the driver's cabin, turn the ignition on, return to the crank, and this time, catching it on the down stroke, give it a quick spin with plenty of THAT. The engine almost always responded— first with a few scattered explosions, then with a tumultuous gunfire, which you checked by racing to the driver's seat and retarding the throttle. Often if the emergency brake hadn't been pulled all the way back, the car advanced on you the instant the first explosion occurred and you would hold it back by leaning your weight against it. I can still feel my old Ford nuzzling me at the curb as through looking for an apple in my pocket.

Most everybody used the reverse

pedal quite as much as the regular foot brake—it distributed the wear over the bands and wore them all down evenly. That was the trick, to wear all the bands down evenly, so that the final chattering would be total and the whole unit scream for renewal.

The lore and legend that governed the Ford were boundless. Owners had their own theories about everything; they discussed mutual problems in that wise, infinitely resourceful way old women discuss rheumatism. Exact knowledge was scarce, and often proved less effective than superstition. Dropping a camphor ball into the gas tank was a popular expedient; it seemed to have a tonic effect on both man and machine. The Ford driver flew blind, the dashboard of the early models was bare save for an ignition key. He didn't know the temperature of his engine, the speed of his car, the amount of his fuel or the pressure of his oil (the old Ford lubricated itself by what

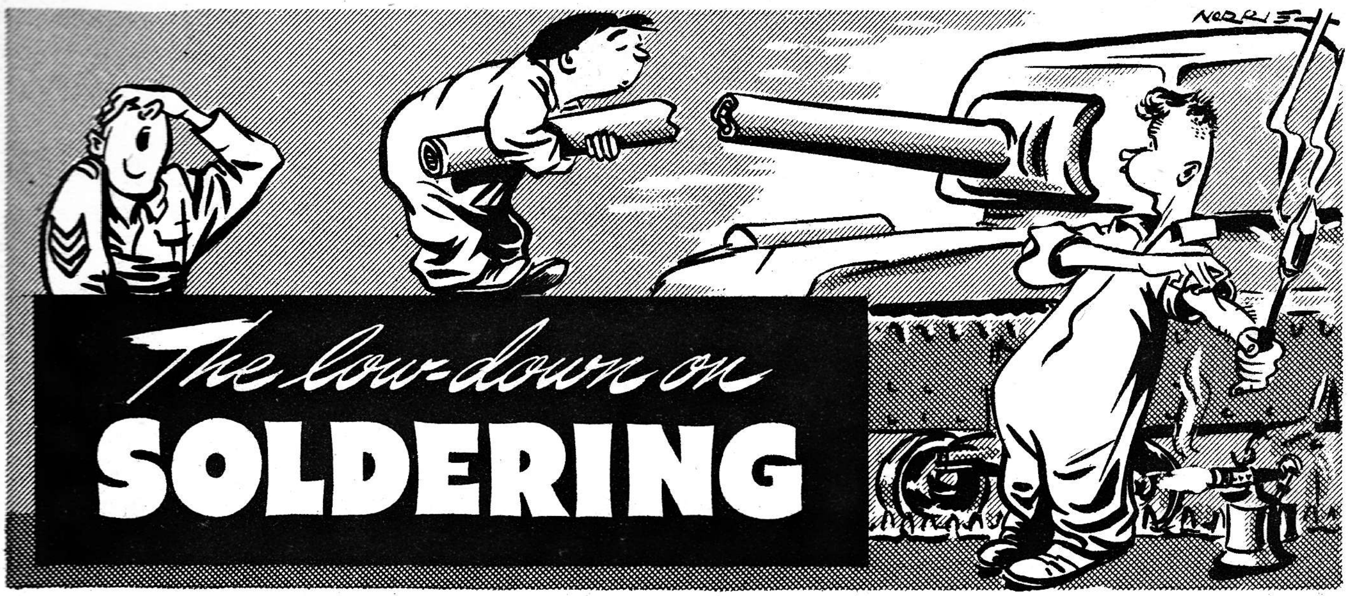


was amiably described as the "splash system"). He learned not through instruments but through sudden developments. The timer was one of the vital organs about which there was ample doctrine. Some people, when things went wrong, just clinched their teeth and gave the timer a smart crack with a wrench. Others opened it up and blew on it. There was a school that held that the timer needed large amounts of oil; they fixed it by frequent baptism. And there was a school that was positive it was meant to run dry as a bone; they were continually taking it off and wiping it. I have had a timer apart on a sick Ford many times, but I never really knew what I was up to—I was just showing off before God. I remember once spitting into one; not in anger, but in a spirit of research. You see, the Model T driver moved in the realm of metaphysics.

A Ford owner had Number One Bearing constantly in mind. This bearing, being at the front end of the motor, was the one that always burned out, because the oil didn't reach it when the car was climbing hills. (That's what I was always told, anyway.) That bearing was like a weak heart—you could hear it knocking, and that was when you stopped and let her cool off. Try as you would to keep the oil supply right, in the end Number One always went out.

Springtime in the heydey of the Model T was a delirous season. Owning a car was still a major excitement, roads were wonderful and bad. The days were golden, the nights were dim and strange. I still recall with trembling those loud, nocturnal cries when you drew up to a signpost and raced the engine so that the lights would be bright enough to read destinations by. I have never been really planetary since. I suppose it's time to say good-bye.

X Y Z



The low-down on SOLDERING

Being a fearless expose of the generalley held misconception that to be able to solder required a natural born talent, a good luck charm and a belief in the supernatural.

IN the days when, if you owned a radio you made it yourself, or if you operated an automobile you fixed it yourself—the fine art of soldering was known and practiced by every amateur mechanical tinkerer.

Within the past ten years or so this art seems to have been as completely lost as the art of weaving your own shirt.

Now, (or immediately prewar anyway) you pays your money and gets your radio, and if anything comes unstuck you dial your local repair man, tell him the radio has quit and up he comes with his screwdriver, pliers and soldering iron to fix it.

Civilization had marched on to the age of telephones, service men and service stations. But things have changed again. For one thing you've got yourself into the army. In fact into this Unit garage or Workshop and a flock of Joes are handing **you** stuff to fix.

Among the many things to learn in soldiering was *soldering.*

Not that there's anything to it—once you know the facts and the factors involved and if you're old enough to play with matches now's the time to learn.

Why Solder?

Solder is a metallic joining agent that has a low melting point—so that gives us one good reason for using it where we must not, or don't want to raise the temperature of the work too high.

Solder is a good electrical conductor—a second reason for using it therefore is where we want to conduct electricity.

Solder has high anti-corrosive qualities—our third reason for using it on joints exposed to corrosive action.

Solder is flexible—a fourth reason for using it where vibration or the effect of temperature changes would cause expansion or contraction of metal joints .

Where high tensible strength is not a necessity you can add a fifth item—it's the easiest way of doing the job. You don't need elaborate equipment or special training.

From the foregoing features you can see why soldering comes into the picture in electrical work in a big way. Play about with too much heat near a rubber insulated nest of copper wire and you end up with some new circuits—mostly short ones.

With solder being a good conductor you get a good low resistance joint. Being anti-corrosive you seal the joint against the penetration of atmospheric oxygen, thereby putting a stop to oxidization at the point of contact and assuring that the joint won't increase in resistance with age.

Of course soldered joints are not confined to electrical wiring. Tinsmiths, radiator repair men, plumbers, instrument men and mechanics should find a soldering iron more useful in its intended role than as a door stop.

In the army these days you're not going to be able to be too choosey in your particular choice of irons, and solders. You take what you get and like it—that is, all except one thing—flux.

Flux can be the secret to success, the nigger in the woodpile or the sabateur of a job you think is a masterpiece— and here's how.

Generally speaking, flux is the stuff whose job is to protect against or dissolve the oxides which are on the surface of all metals, because

solder won't stick to an oxidized surface. By an oxidized surface we don't necessarily mean one that looks like a rusty old nail. Sometimes an oxidized surface looks cleaner than the buttons you were supposed to have shined this morning.

So, when heated, this flux has to take care of the oxides and allow the solder, while molten, to alloy with the metal surfaces to be joined.

Any so called acid flux will do this when properly used. But the sabateur sneaks in, especially if its an electrical wiring joint, when the wrong type of flux is used.

There are more kinds of fluxes than wrinkles on an orderly sergeant's brow and they vary in character from very strong acids to very mild acid bearing substances.

For delicate electrical or wireless use, it's very important to remember **not** to use the strong acid fluxes.

The best flux for this type of work is resin (or rosin if you like). This is known as a protective type flux. Resin, contrary to general belief does not remove oxidized films. However, used on well cleaned copper, brass or tin plate where relatively low working temperatures are required, resin flux gives excellent results in preventing oxides forming.

Where higher temperatures are involved and the job of cleaning the joint of corrosive flux residue is practical, a more chemically active flux is the best bet. As common as any is zinc chloride. It has the ability to clean the solder and the joint surfaces and maintain this condition at the soldering temperatures. The thing to remember about this type of flux is the absolute necessity of thoroughly cleaning the finished joint of all traces of corrosive flux residue.

While resin contains acid in its natural make-up due to it's physical characteristics it is non corrosive, it's residue is a poor conductor and doesn't tend to collect moisture, dust and such like trouble makers. The best no-muss-no-fuss way of handling this flux for fine work is when it is contained as a plastic core within the solder.

Which brings us to the solder itself. Here again there's more varieties than need worry us.

Solder is usually an alloy of two metals—tin and lead. With tin on the shortage list—the Japs having copped the biggest percentage of the world supply—solder alloys have suffered accordingly.

There are other combinations, as substitutes or for special jobs. Antimony, Zinc, Silver, Cadmium, and even Mercury are some of them, but the tin-lead team are your most likely issue.

Right here, one of nature's peculiarities turns up. Lead melts at about 625°F and tin at about 450°F. Yet an alloy of these two metals produces a melting point, depending on the proportions, lower than either—around 360°F. This proportioning of tin and lead in a solder also has a strange effect upon it's behaviour.

Fr'instance if 37% lead gets mixed with 63% tin we get what the smart money calls a eutectic mixture A solder that is either solid or fliud. There's no plastic or mushy stage in its change from one state to the other. However, as soon as you increase the proportion of either tin or lead from this one point, the solder goes through the mushy state when changing from solid to fliud—or vice versa.

For this reason all commercial solders are non-eutectic alloys—the proportions being governed by the work requirements as they effect the hardness, shear strength and tensile strength of the solder.

All of which is very interesting—but what about Joe when he finds himself with a soldering iron, a lump of issue solder, a can of flux (minus label) in his lap and a ruby-faced Sergeant, yelling for results, on his neck.

Three little Figs ....
on Shape and Handling.

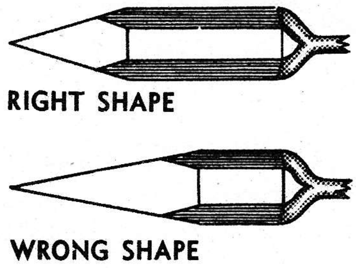


FIG. 1.—The blunt one delivers its heat fast.

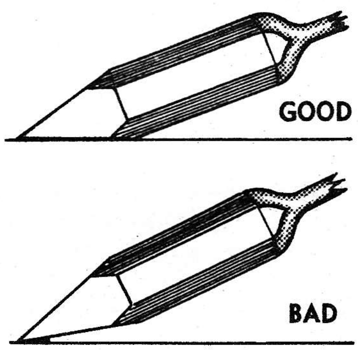


FIG. 2.—Or you can have the proper shape and still get poor heat transference by wrong handling.

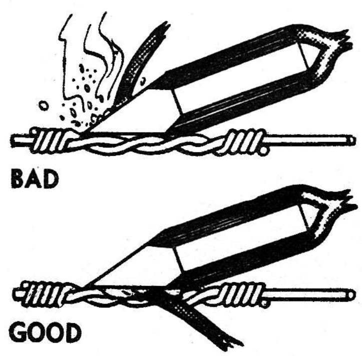


FIG. 3.-We're not interested in soldering the iron, or melting the flux on it—right on the job is where the solder and flux belong.

From this point on the results depend on the practice—not the theory.

So get rid of any apoplectic sergeants and start pumping up the torch for we've got to have heat and there are a couple of booby traps about for the unwary.

We can usually apply heat in two ways—via hot iron or with an open flame.

The iron (which incidently is copper), heated either by blow torch or electricity is the usual method especially where we don't want to raise the temperature of the work over too wide an area as would happen with an open flame. The flame also has the disadvantage of causing excessive oxidization and carbonization of the work and a strong flux is then required to overcome this film.

A good rule to follow then, is to keep flame away from the surfaces to be joined. Use an iron.

The likeliest snag that can occur then is when Joe doesn't realize that he must raise the temperature of the **work** to the point where the solder will flow and **alloy** with the metals to be joined.

This is one reason why you can quickly develop caffeine nerves, pink tooth brush and lines of worry, trying to do successful soldering with too small an iron or a poorly shaped iron. Both will not deliver sufficient heat to the work to overcome its radiation (Fig. 1). You're more likely to get results with a heavy iron on light work than a light iron in heavy work.

That settled, your next worry is tinning the iron.

This simply means getting a smooth coating of solder on the tip of the iron and is to overcome our old friend—oxidization.

Oxides, besides being poor electrical conductors are also poor transmitters of heat—so a crust or scale of oxide on our iron's face will destroy its efficiency in heat delivery.

Strangely enough, too, molten solder when in contact with a tinned iron is adhesive—while if the iron is oxide coated, the opposite phenomenon occurs. So you tin your iron—this-a-way. First clean the faces with a file. While the iron is heating in a smokeless flame, find yourself a scrap of tin plate on which you put some solder and resin type flux, and then rotate the iron's tip in it until it is solder plated.

Now you're all set to start the job. Heat the iron again—but keep an eye on it. If you get the iron to a nice cherry red you'll undo all the cleaning and tinning process you just finished and will have formed a scaley oxide crust on it. Just hot enough to freely melt solder is what you want.

Make sure the parts to be joined are perfectly clean and if you're not using a solder with a flux core, coat the parts with flux.

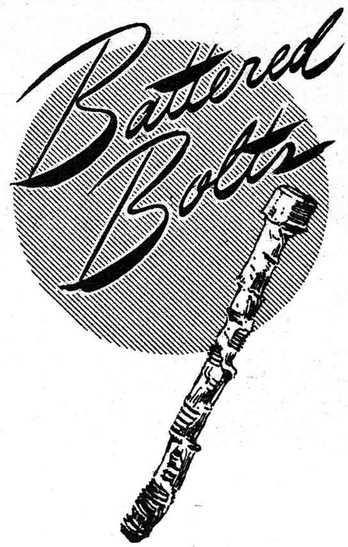
Now apply the iron to the work and then the solder—making sure that the temperature of the **parts to be joined** is high enough to melt the solder.

If you're using a cored solder a quick look at Fig. 3 will show the right and wrong of handling this.

Now the big thing to remember is to keep the two parts being joined **absolutely still**—not a move—while the solder goes through that mushy stage we told you about before solidifying. This is the critical moment when the least movement of the parts can cause a partially fractured joint that sometime later will come undone—or if it's electrical work, produce a hard to find loose connection. This shows that it's a bad habit to hold one part of the work in your hand while joining it to the other.

Now call in the red faced Sergeant and take the strain off his blood pressure. Tell him you can handle his soldering jobs like nobody's business. On second thought —better work in a couple of practice jobs first.

x y z



These 90 day M.T. Inspections sometimes turn up some interesting and strange things.

Sometimes sad things.

Take springs for instance. Day in and day out M.T. Inspectors are gazing on broken spring clamps, centre bolts and 'U' bolts loose and allowing the leaves of the springs to fan out like a bridge hand.

Recently, one unit motor mechanic dug up one of these centre bolts to show the Inspection Officer. It bore little resemblance to the original bolt and had taken a terrific beating. It looked like something that Rover had just finished with. The pay-off came when the mechanic started condemning the manufacturer for putting out a bolt that would get into such shape.

Had it been made from hardened stock as suggested it would undoubtedly have sheared off long before the first of the mass of offsets had been put in.

Had the spring clamps been watched as they should, U bolts and centre bolt tightened up when the check up was or should have been made—the bolt would still be straight and in service.

In fact, had the M.M. hidden that bolt instead of condemming the manufacturer and decided that the C.P.M.S. 1-2-3 routine needed looking into—the sad picture would be brighter.

Symple SYMBOLS

Push a lubrication system, cooling system or carburetor circuit diagram under the nose of the average mechanic and he'll tell you all about it before you can say schicklegrubersabum backwards.

Substitute an electrical wiring diagram and in most cases you'll have time to read Mein Kampf in reverse (thats the way to read it now anyway).

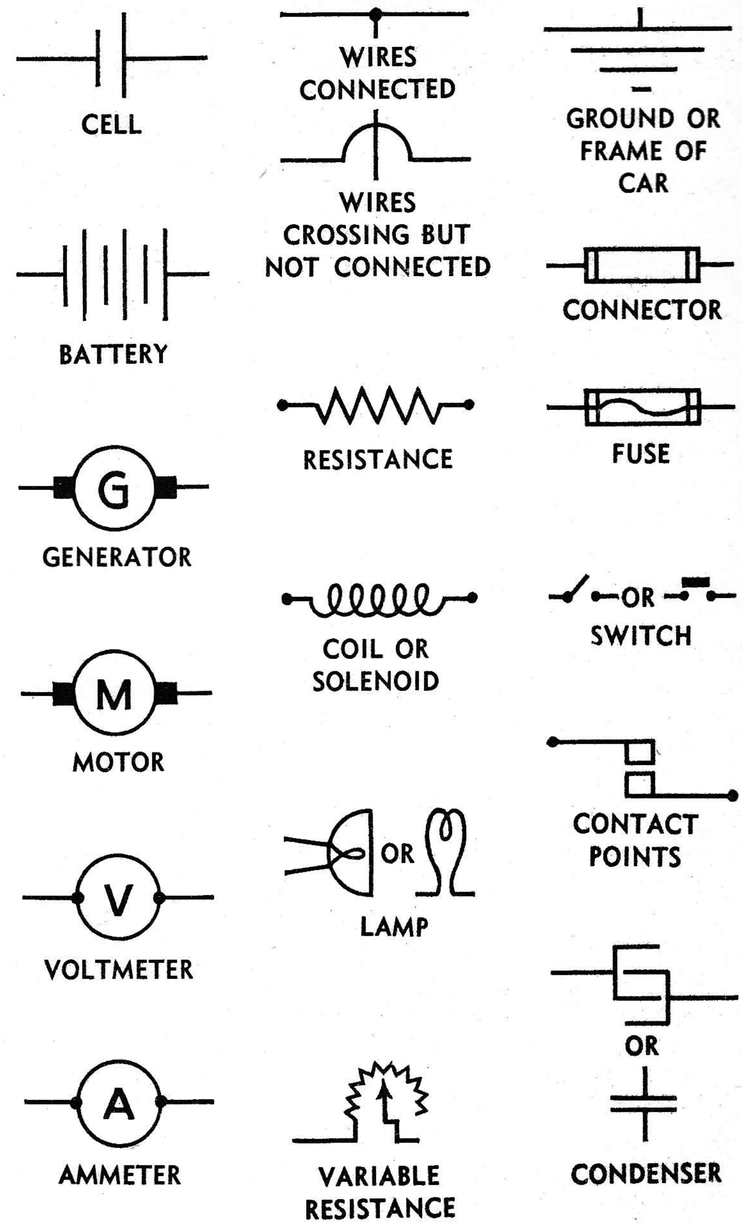
An exhaustive study of this situation has produced the fact that its those whirlygigs, ziz-zags and loops, used to represent the various components in electrical diagrams, causing all the trouble.

It's just a matter of symbols.

You couldn't have everybody making electrical circuit diagrams with pictures of motors, generators, condensers and things. Apart from the time required—most electricians are not artists—one man's condenser might look like another man's coil. There would be no end of confusion.

So standard symbols that are simple enough for anyone to draw are used instead.

There's plenty more symbols used in the more elaborate circuits of radio or wireless than we've shown here. However these are the ones you are most likely to bump into in automotive work. Get to know them and you'll have the answers to any automotive circuit that's likely to come under your nose.



→ = DIRECTION OF CURRENT FLOW

E = VOLTS

I = AMPERE

P = POWER

R = RESISTANCE

+ = POSITIVE

− = NEGATIVE

VALVES—Hot, Fast and Ticklish

Back in the good old days, a little old lady used to drive into our shop about every sixty days, point to her car, and pipe, "Wash it, grease it, and grind the valves."

THAT was to show us she knew what was going on under the hood—but the little old lady wouldn't of known a valve if one had walked up to her and called her grandma.

Like the little old lady, there are plenty of knuckle-busters who know there's a double-handful of valves under the hood, but who've slept through the latest developments.

And from the number of valve jobs coming in to army shops, there might even be a couple of oldtimers who surely don't know that the old, grey valve, she ain't what she used to be.

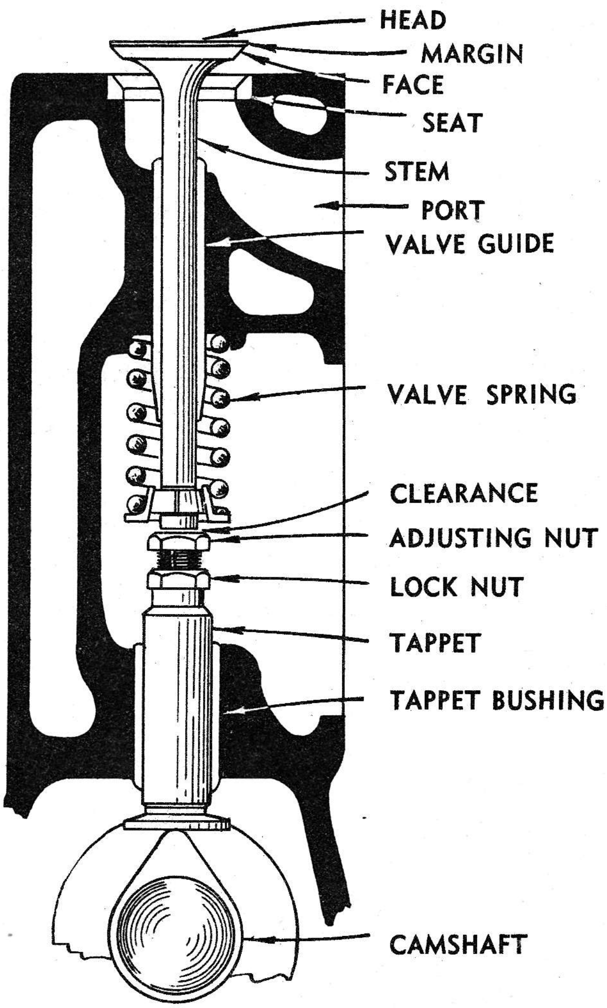
Around 1913 and sometime thereafter, the life of the valve was an easy one. Low-compression and low-speed engines were the fashion.

Four-to-one compression ratios were common, and the piston only compressed the fuel-air mixture to 50 lbs. per square inch. The resulting explosion after ignition, developed a pressure of only about 200 lbs. per square inch—that's all the valve was called upon to seal into the combustion chamber. What's more, it could take its own sweet time about opening and closing since engines were low-speed as well as low-compression.

But compare these pressures with the pressures of modern engines. Compression ratios of 6 to 1; fuel-air pressures of 100 lbs. per square in; and explosion pressures of 400 lbs. per sq. in. The valve is the sucker that holds it in.

To hold the lid on these pressures, and to allow the inhale and exhale of the combustion chamber at high speed, the valve has to be perfectly timed. The opening of the valve is timed mechanically by the camshaft—but the return of the valve to its seat is the job of the valve spring.

Any weakness of the spring spells curtains for the valve; time wasted



The valve assembly: *A weak link in the chain turns engine efficiency to engine deficiency.*

in reaching the seat or bouncing after it gets there, is a kick in the bustle for the valve.

Why?

Well, did you know an exhaust valve at work is cherry-red? The only chance it gets to cool off, is on the seat—which, as you know, is usually water cooled. The terrific heat the valve picks up from the firing chamber, must be dissipated through the seat and guide—otherwise, it will curl up and die like a dry leaf on a hot stove.

A factory representative named Beanie once showed us how cooling of the valve works. He took a hunk of cigarette paper and held a match to it. It went up in smoke. Then he took another hunk of cigarette paper and wrapped it tightly around a penny. When he held a match to it this time, the paper held out for a long while before finally burning.

The secret was that the copper penny picked up the heat quickly, saving the paper from burning.

That's the way valves get cooled—the water-cooled seat picks up the heat they collect from the combustion chamber.

(Beanie sure sold us a lot of valves. He later drunk himself to death.)

Since the valve opens and closes about 1200 times a minute at moderate speeds, and because of its high temperature, it can't afford to miss that cool seat even once. Furthermore, it dassent allow the engine to lose power because of lost compression.

For these and a couple of other reasons, the valve deserves a lot of care and the parts of the valve train must be kept free acting.

Take close tappet adjustments. This is probably one of the most common causes of burnt valves. Like we mentioned, the only chance the valve head has to cool is when it's on its seat, except of course, for the small portion of the heat that is dissipated through the valve stem. The valve is on its seat three strokes out of four but if the tappet clearance is too close the valve is held open longer, it gets exposed to the heat longer and sits on the cooling seat for a shorter time. The remedy of course is to follow the manufacturer's instructions to the letter—even if it means standing on your head over a hot manifold, holding the feeler gauge between your teeth and a tappet wrench in each hand. This clearance has got to be just what the manufacturer ordered so don't guess at it and don't give up till you're sure it's right.

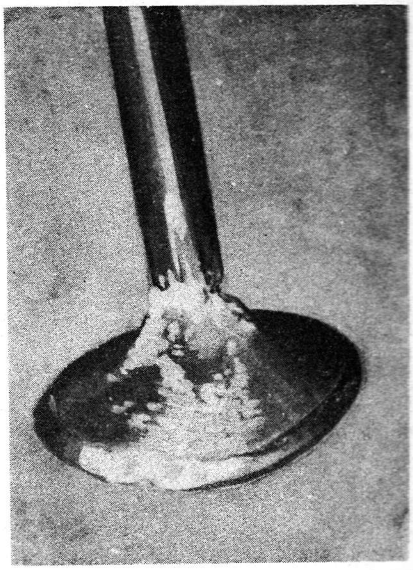
Worn valve-guides promote vacuum leaks, sponsor poor heat dissipation—louse up the alignment. Poor alignment will indubitably cause the valve to hit the seat cockeyed or create a thrust action which may break the valve stem.

The valve seat deserves attention. Examine it for cracks, if it's the insert type 'sound' it for looseness in the block or head. The heat from the valve has to pass through the seat to get to the block and the cooling system. It's got to get there fast and if the seat is loose, it won't be conducted as rapidly as it should.

If the cooling system is clogged or dirty, very often it's the valves that take the rap. Lots of cases where one or two valves burned out in an engine have been tracked down to what are known as "local hot spots". The local hot spots have nothing to do with Sluggsy's Jive Joint or similar recreational centres but are caused by deposits of scale, rust, old hose and whatnot collecting at one or more points in the cylinder block—resulting in poor heat dissipation at that spot.

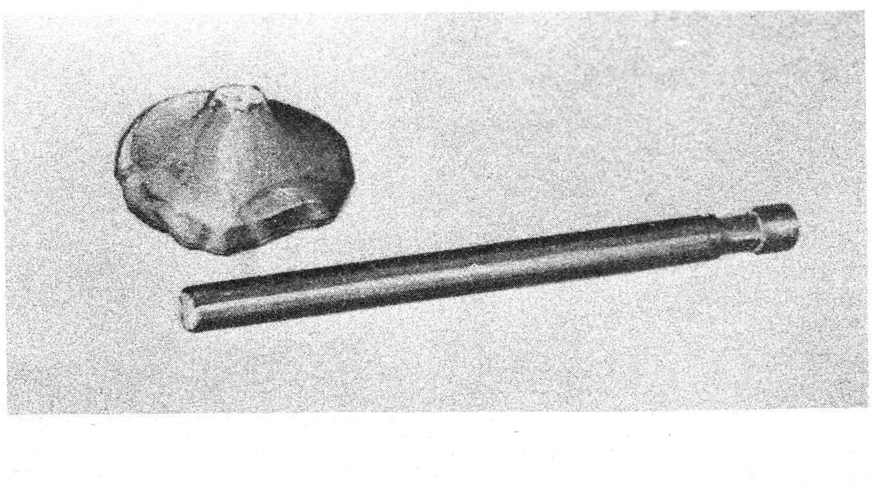
Sadly enough, this condition is seldom registered by the heat indicator and the first word of it may be burnt valves.

The only prevention for this sort of dirty work is regular checking of



This little valve got burned: ***That's what comes of missing the nice cool seat. Blame bad adjustment, weak springs, etc.***

This little valve got broken: ***Blame it on bounce caused by weak springs, or too strong springs which seat the valve with a wallop.***



the cooling system. When the rad is flushed, don't forget the block is part of the cooling system too. Whenever an engine overhaul or valve job comes up—remember that cleaning out the cooling system is part of the job.

When you grind a valve, grind it to the proper angle, and be sure the width of the seat is the width the manufacturer wants it.

Refacing is important to a woman and to a valve. The job on the valve is begun with a true stone, which is dressed as often as needed. Check the grinding angle while setting the machine—a split-hair error screws up the job. If you don't have at least a slight margin above the ground surface on the head of the valve, replace it. Be sure the retainer grooves on the stem aren't worn.

While refacing, take small cuts—but don't remove any more material that you have to, to get a true face at the correct angle.

For an accurate and quiet adjustment, hold the tip of the valve in a V-block and true it up on the wheel.

Maybe you've wondered why manufacturers make different recommendations on lapping or grinding valves after the refacing and reseating operation.

Some say lap 'em in lightly, others don't advise lapping, just say reface and reseat 'em good.

Some manufacturers use a special hard valve seat on the exhaust ports only—and recommend that only intake valves be lapped.

The main thing is—don't guess. In all cases, follow the manufacturers recommendations—and everything'll be jake.

Poor carburetion—especially a lean mixture plays hell with the valves. The reason for this of course is that the temperatures of a burning lean mixture is much higher than normal. Also a lean mixture burns slowly and the flame of the burning gases linger in the cylinder—sometimes the flame is still in the cylinder when the intake valve opens on the following stroke—that is why a lean mixture sometimes cause a popping back through the carburetor.

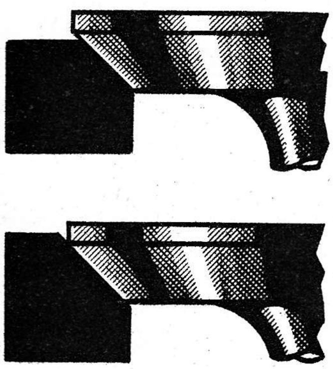
A rich mixture is hard on valves too. Rich mixture causes rapid and excessive carbon formation which acts as an insulating blanket— keeping the heat in. It also causes gum which results in sticky valves.

Valves really reached their highest point of perfection in the last year or so—but some of the metals that went to make them so good are on the critical list—chances are they'll be yanked out. This means that valves containing 5% nickel and 25% chromium, might get a no-nickel-and-9%-chromium substitute.

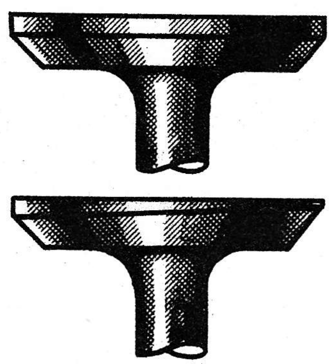
To you, this means that the new valves must be given all the breaks. Of course, if you'd rather, you can stick around and learn the hard way. A broken valve can smash up the guts of an engine as thoroughly as a burned-out rod bearing; poorly adjusted or sticky valves can sap power like another truck tied on behind.

So be kind to your valves—remember, they lead a hard life.

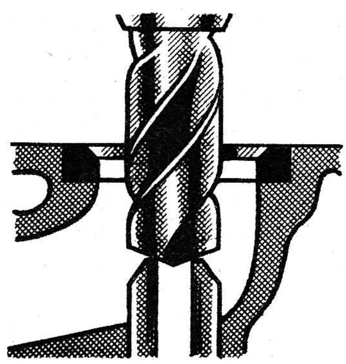
x y z



Width of seat: *Follow the manufacturer's recommendation. It's his seat, give it the width he wants it to have.*

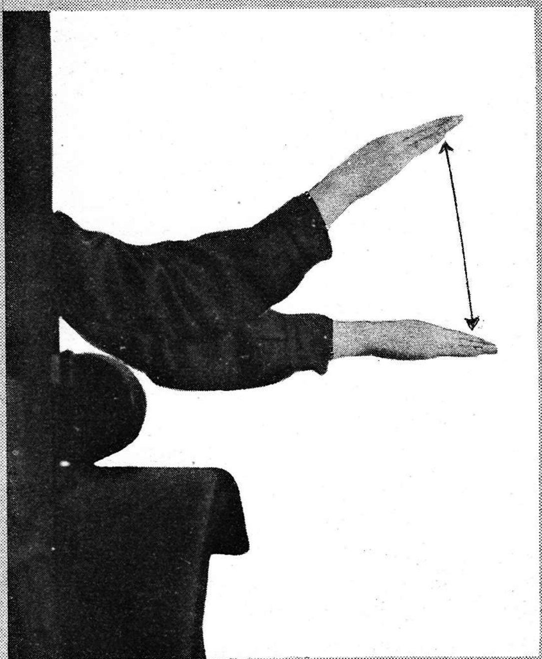


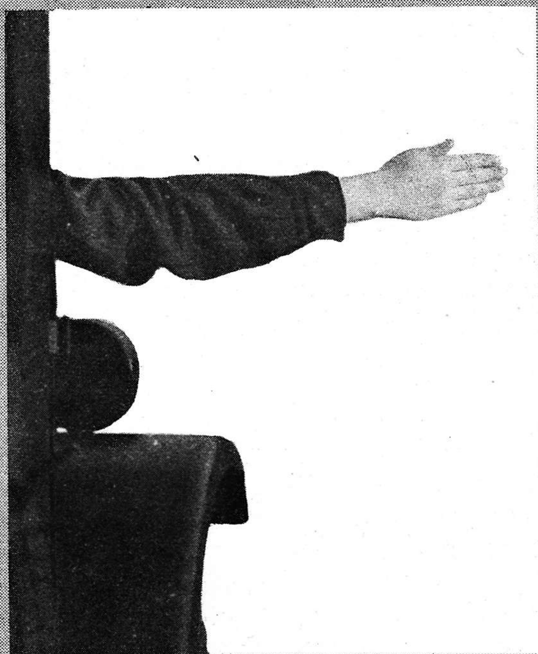
Valve head margin: *If you find any valves with a knife-edge — they're N.G. — replace 'em.*



Shortening valve guides: *Shortening the valve guides is one cure for valve stem deposits. Use a snub nose drill slightly larger than the outside diameter of the guide.*

DRIVERS' SIG





I AM GOING TO SLOW DOWN OR STOP

Extend the right arm with the palm of the hand turned downwards, and move the arm slowly up and down keeping the wrist loose.

The Co-Driver's signal will be the same as the Driver's except the left hand will be used.

I AM GOING TO TURN TO MY RIGHT

Extend the right arm and hand with the palm turned to the front and hold them rigid in a horizontal position straight out from the side of the vehicle.

The Co-Driver's hand signal will be to extend the left arm out from the cab, lower arm upwards and palm facing forwards.

I AM READY TO

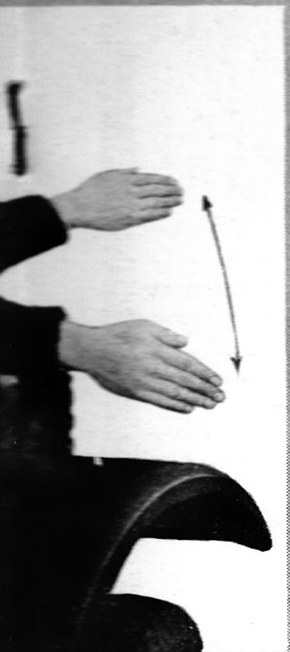
Extend the rig below the level o move them backw

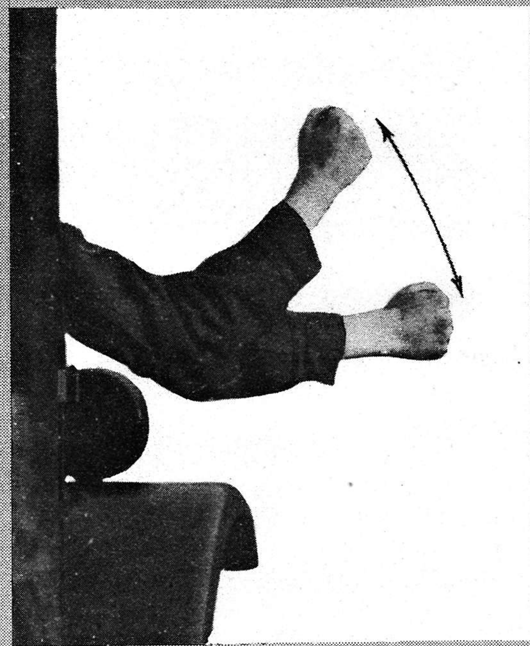
The Co-Driver' same as the Drive cept the left arm

QUITE apart from giving the high sign to a slick chick, finding out if it's raining, or snatching suckers from the kiddies as you go by—the use of the upper flipper to advise other road users of your intentions (good or bad) has come to be regarded as highly recommended procedure. In fact the army—ever watchful of your welfare—insists on it.

The above gallery of "handouts" picture the latest correct and standard signals that meet the approval of civil and military highway authorities. You will immediately notice that they show a right hand drive vehicle. You will also notice in the little caption for each picture that the appropriate signal is described for the co-driver (that's the chap sitting next to you unless you're on a solo m'cycle—a circumstance

N LANGUAGE





D BE OVERTAKEN

ight hand and arm of the shoulder and kwards and forwards.

er's signal will be the ver's hand signal ex- will be used.

I AM GOING TO TURN TO MY LEFT

Keep to the centre line of the road and extend the right arm out from the cab, lower arm upwards and palm facing forwards.

The Co-Driver's hand signal will be to extend the left arm and hand with palm turned to the front and hold them rigid in a horizontal position straight out from the side of the vehicle.

I AM GOING TO INCREASE SPEED

Extend the right arm and hand with fist clenched and move it up and down rapidly between shoulder and waist.

Co-Driver's signal will be the same as the Driver's except the left arm is used.

which calls for a very clever co-driver who can get along on nothing). However, where this gentleman is a practical addition, by all means have him give the correct signals too—he's more likely to be seen by following, or overtaking, drivers.

If you are by yourself in a right hand drive vehicle use super caution. Give the signals and then drive on the assumption that they were not seen.

If you're in charge of a left hand drive vehicle—follow the rules for co-drivers of right-hand drives.

At all times play safe—it's not sissy. It's just plain smart to protect yourself and the other fellow by not expecting him to be any more of a mind reader than you are.

Contributions

Do you know how to make maintenance easier? We're asking you.

Maybe you've got a better way of doing a job—perhaps a new trick for your trade.

If so, write CAM and let the rest of the boys in the field in on it.

UNIT ....
UNIT GARAGE NO. ....

WORK ORDER
NO. ....

D.N.D. NO.	MAKE & YEAR	SERIAL NO.	MILEAGE	DATE IN	DATE OUT

Authorized to proceed with work UNIT MT OFFICER

INSTRUCTIONS

PARTS REQUIRED

PART NO.	QTY.	Description of parts	Installed By	Approved

SPARE PARTS INDENT NO.

TIME RECORD

Mechanics' Name	Nature of repair	Time required

Posted in Vehicle Log Book

....M.T. Clerk

Repairs Properly Completed

....M.T. Officer

U/G WORK ORDER

Something to evoke hoarse cries of joy from grizzled M.T. Sergeants and M.T. clerks across the Dominion fluttered onto our contributions desk tuther day.

"A suggestion for a standardized Work order" says a voice from the middle distance, which turned out to be Lt. W. R. Young of the Vehicle Engineering department and late of various unit garages in and about the country.

Up to and including today, the Lieut. tells us, there is no official laid down pattern for these forms—every unit garage either mimeos its own version or uses old jam labels, discarded shirt fronts and assorted tissue.

The Form illustrated here is the result of a quick survey of several forms now in use by various units and the adaption of the best features of each.

It wraps up all the information in one neat package for the M.T. Officer that authorizes the work, the mechanic that does the repair and the M.T. clerk that posts the records and indents for parts.

Look it over. It is just about self explanatory but there are a couple of things about it that may not be apparent to your first bashful glance.

The work ridden M.T. clerk for instance will find aid and comfort. From this work order he will have the complete information for his vehicle log book posting of record of repairs.

The Spare Parts indent also can be made out from the information under Parts Required. A 'built-in' time record for unit mechanics completes his happy picture.

The vehicle make, year and serial number provides the tip-off for a check on any modification required and the N.C.O. in charge should include these in his work instructions where applicable.

If it looks good to you there's no trick to running off your requirements on the mimeograph. Lacking these facilities, get District Printing and Stationery to run them for you.

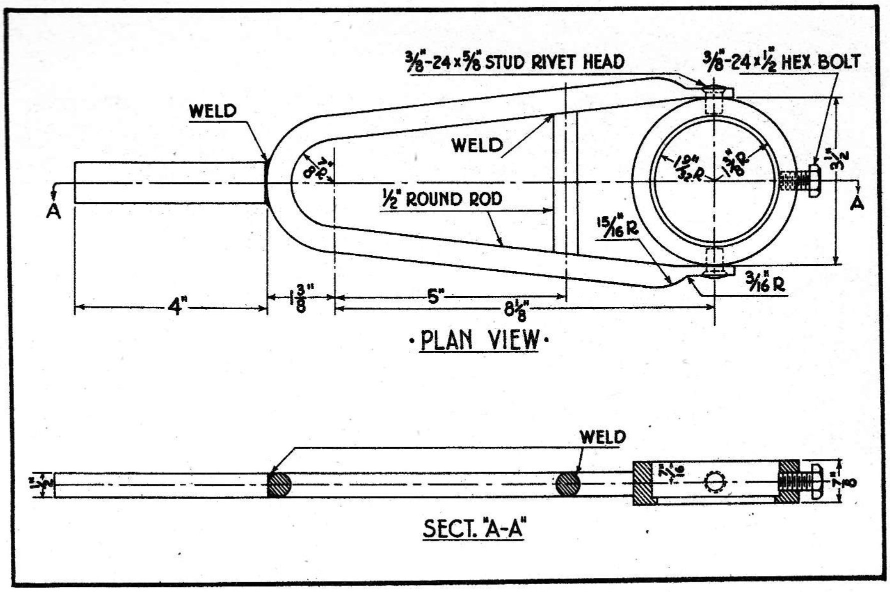
DIE HOLDER FOR THREADING 'U' BOLTS

Ever been confronted by the problem of threading, or extending the threads, of a 'U' bolt?

S.Q.M.S. C.D. Wilson No. 1 Proving Ground Det. has the answer—as shown in the drawing which gives all the details.

This tool saves all the sweat and tears of straightening out a 'U' bolt to allow a conventional die holder to work—by allowing the handle to pivot in the die holder.

We can see where this might be a mighty handy tool to have in some other "close quarters" threading operations.



Coil Carnage

THE other day we were busy listening in on our trick party line phone. (We pick up lots of Part III by this means) and we tuned in on a certain Spare Parts character in the throes of a violent nervous fit.

A quick recce by our number one boy, Sniffer by name, brought to light the *cause célèbre.*

Delco-Remy Coils.

The number of Delco-Remy Coils of the lock-switch type being thrown at Salvage, all chewed and battered to billyo, were piling in faster than he could duck.

This he claims is one of those horrible examples of over-developed muscles and under-developed brains on the part of the guys that take these coils off the vehicles to test them.

The coils can be taken off quite easily and quickly—if you go about it the right way with a thin blade of spring steel instead of a sledge hammer and tin snips.

An old discarded piece of feeler stock (.015" x ½" if possible) is ideal and here's how it's done: Insert the thin blade of spring steel between the coil case and the coil end cover at a point approximately one inch to the left of the cable outlet or seam on the coil case.

Push tool between lock and recess as indicated in our illustration.

Twist end cover in the direction indicated (counter-clockwise to you) until the lock is released from the lock recess.

Remove the tool to relieve the pressure between the cover and the coil.

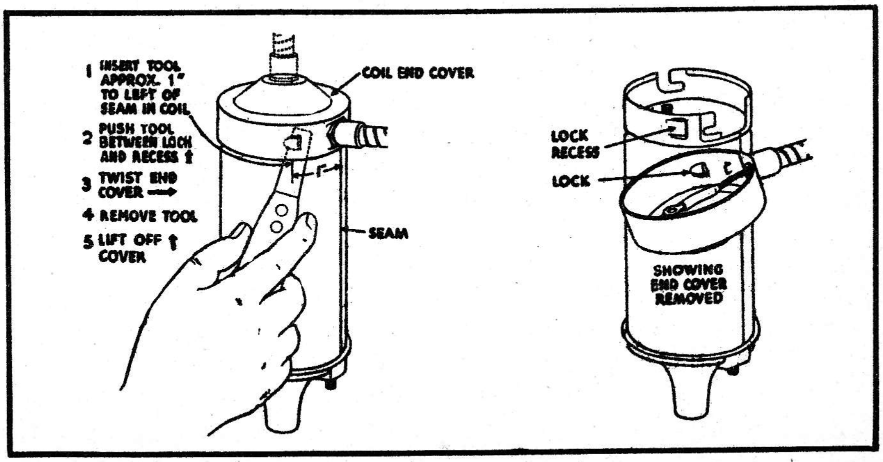
Lift off the cover and disconnect the lead from the terminal on the coil.

Simple as opening a bottle of milk.

What comes off usually goes on, so to re-assemble the coil cover and switch extension assembly without damage to the coil, or your well-controlled temper, you might as well do it this way:

Connect the extension lead to the terminal on the coil. Align the locating lugs on the cover with the "L" slots in the coil case so that the lock will be on the same side as the lock recess. Press cover in by hand (but don't force it) and twist the cover clockwise (opposite to taking it off) until the lock snaps into the lock recess.

Now you can take that can-opener off your lanyard and a load off the Spare-parts character's mind.



Sgt. O'Sweat's — HEADACHE and ASPIRIN Department

Here's answers to a few of the headaches the Sarge found in his mail-bag this month—Have **you** got any pet troubles you want to share with the Sarge?—Where you'll be thirty years from now—or where your last months pay disappeared to etc. etc. Strictly speaking, he only answers personal questions on his own time but if you have any technical maintenance problems write to Sarge O'Sweat—Cam Magazine, Directorate of Mechanical Engineering, Dept. of National Defence, Ottawa.

Dear O'Sweat.

This question I am about to ask may sound a little ridiculous to you but I' hope you will be good enough to answer it for me without calling me a dunce.

I have run into more than one Ford vehicle that has caused me no end of grief. These particular vehicles have had a great deal of work done to them including a complete check up of the carburetion and ignition systems. After all work was completed the vehicles still lacked their usual power and seemed very sluggish. While new pistons had been installed and the valves ground there does not appear to be any tightness when the engines are cold or hot. Due to the fact that the vehicles will roll easily on the floor I am sure the brakes are not dragging.

Any suggestions you can offer me as to where else I might look for trouble will be greatly appreciated.

Pte. J.J.M.

Dear Pte. J.J.M.:

First of all my friend I want to tell you that you aren't a dunce because dunces are the fellows who **don't** ask questions. Now let's dig into your mystery.

You say the ignition system has been completely checked. Hmmm. It still looks to me as though you have a case of ignition trouble. I have run into several of these Fords that act just about the way you explain. The trouble is often tied up in the distributor cam and weight assembly. There are three things that can go wrong (not counting wear) which will cause a retarded spark, resulting in loss of power and sluggishness.

Check the automatic advance weights for freeness, because often they became frozen or gummed up. If this happens you won't get the proper amount of advance. Another cause of improper spark advance is wrong parts. Make sure the part numbers stamped on the distributor shaft and on the cam and weight assembly start with the same prefix. In other words, don't use a 78-12175 shaft with a 11A-12175 cam and weight. Here's the third item that may be the fly in your beer. Take a good look at how the cam is fastened to the governor weights. You'll find it's swedged. In some cases this becomes just loose enough to allow the cam to turn a few degrees. When it does it naturally follows that the engine is out of time and is usually late. Often it's so late no matter how far you advance the timing screw on the side of the distributor you can't make the engine ping. You can usually tell if the cam has shifted by the location of the swedge marks but if you're stuck check with a new cam.

O'Sweat

Dear O'Sweat:

Can you explain why the porcelains of spark plugs vary in colour when they are out of the same engine. Sometimes we find that two or three of the plugs are almost white while the rest may be a light brown, a dark brown or in some cases almost black.

We have checked with Spare Parts and found the spark plugs to be the correct ones for each job but still they vary in colour. We have found this condition in Fords, Chevs., and Jeeps.

Sgt. F.L.E.

Dear Sgt. F.L.E.:

For a minute there I thought you might be using plugs of different heat ranges in the same vehicle. That has happened you know even in the best of regiments. However, I'll take your word that you have carefully checked this point and also made sure the spark plugs being used in each vehicle are the ones recommended by the manufacturer.

The correct colour of the porcelain (if everything is normal) as you probably know, will be a light brown. There are other factors tho' that may affect the colour of the porcelain besides the type of plug and no doubt one of these is causing your trouble.

When the porcelain is white or a tattle-tale grey the plug is running too hot. This can be caused by a dirty spark plug gasket or the plug may not be properly seated on the gasket. It must be remembered, the heat from the plug has to travel through the gasket before it can reach the cooling system. That's one reason why you should always install a clean new gasket every time you replace spark plugs. A lean fuel mixture will also cause the spark plugs to run hot just like it causes the valves to overheat. Pinging is another cause and brother — this really heats 'em up and sometimes cracks 'em.

You can always spot a plug that's operating too cold when the porcelain is dark brown or sooty-black. Leaving out the spark plug gasket altogether will tend to make this condition because then the heat takes a short cut to the cooling system. Rich fuel mixture is usually the cause of the porcelain getting sooty-black. Don't mistake this sooty condition with oil pumping though, because an oil pumping cylinder will cause a somewhat similar effect on the porcelain. One more item that can cause a black or dark brown plug is a missing cylinder. Even an occasional miss at idling speed may play this trick on you.

If you carefully check all the points I have mentioned you should get the bugs out of your plugs and just so you'll know how much to tighten them with a tension wrench. I'll list the proper tension for you and anyone else who happens to be reading your mail.

Plug thread	Cast Iron Head	Aluminum Head
14-MM	30 lbs.	25 lbs.
18-MM	40 lbs.	35 lbs.

O'Sweat

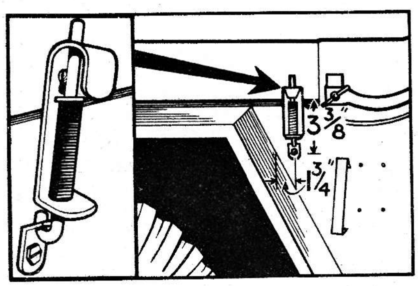
Dear O'Sweat:

In our neck of the woods the roads aren't so hot, most of them being very 'washboardy'. As a result of operating our vehicles over these roads we find a number of breakages of the hood hinges on the Willys "Jeep". The hinges on the hood break away from the hood metal. Welding doesn't seem to be very effective. We are wondering if any of the boys in other parts of the country are having the same difficulty and whether or not you can suggest an effective remedy.

Cpl. J.B.T.

Dear Cpl. J.B.T.:

Looks like you scored a hit because this headache **has** developed in other places. Bad roads are the cause too due to the resulting vibration. The easiest way to get rid of the strain on the hood hinges is to stop the wiggle or if you prefer— dampen the vibration. Here's one simple way to do it that has proved effective.



Indent for a couple of hood catch assemblies, Spare Part No. 5804445. These are the same as used to hold the hoods on C.M.P. Vehicles. Now drill a 1/4" hole in the cowl side panel 3-3/8" from the top and 1-3/4" from the edge. Use this hole to bolt the hood catch assembly into position. You'll have to have something for the catch to hook onto and this is something you'll have to make. Just make a stud similar to the one used with this catch on the regular C.M.P. Vehicles. Then weld it in place on the hood of the Jeep directly above the 1/4" hole you drilled in the cowl. It should be about 1/4" from the edge of the hood.

Well that's all there is to it. One of these on each side at the rear of the Jeep hood will keep it snug even on the roughest of rough roads.

O'Sweat

Dear O'Sweat:

At times our Universal Carriers have to pass through small streams, anywhere from one to two feet deep. As a result of this we have been having quite a bit of trouble with the bogie wheel bearings. We are using D.N.D. 672 grease in these bearings and when we strip the bogie assemblies, after operating in water, we find the mixture of grease and water have combined to form a jelly like substance. This mixture seems to seat itself around the bearings making it almost impossible to force in fresh grease with a grease gun.

Have you any suggestions as to how we can protect the bearings?

Sgt. C.T.A.

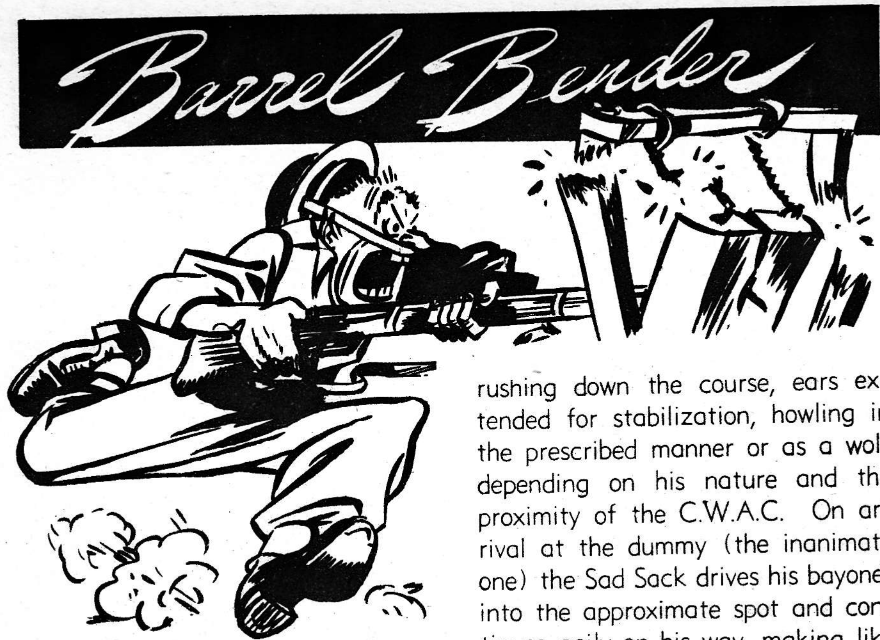
Dear Sgt. C.T.A.:

I'm glad you brought this point up because bearings are getting harder and harder to get all the time.

You can help prevent the condition a little by using D.N.D. 671 grease. this grease will emulsify in water to some extent but not nearly as much as the grease you have been using. About the only sure way out is to strip down the bogie assemby as soon as possible after your Carrier has been driven through water. Clean the bearings thoroughly and repack with new grease. Trying to force the grease in the bearings after they have had the grease and water mixture in them is like attacking a tank with pea shooter. I hear that the boys in some territories found they had to clean and repack these bearings at least once a week to keep their Carriers on the road, until a better solution comes along, you may have to do likewise.

O'Sweat

Barrel Bender

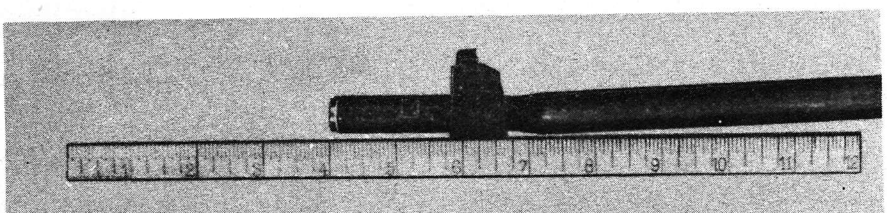


I'M sitting atop the furnace, when home on furlough last week, soldering patches on a water pipe and loudly bemoaning the shortages, particularly of plumbing, caused by this war, when a neighbour comes along and says as follows: "Tsk, tsk, such language, and so unnecessary particularly when substitutes are so easy to procure from the Army Salvage people. For replacement plumbing in my house I fasten old No. 4 rifle barrels end to end by drilling out the chamber and fitting them muzzle to breech until I have the required length and then solder them up."

On returning to my padded cell, I decided to investigate why so many No. 4 rifle barrels are being rendered useless for anything but plumbing. It appears that bayonet practice is the root of the trouble.

Let us look at a group of handsome Canadian Soldiers during bayonet practice. Each soldier goes rushing down the course, ears extended for stabilization, howling in the prescribed manner or as a wolf depending on his nature and the proximity of the C.W.A.C. On arrival at the dummy (the inanimate one) the Sad Sack drives his bayonet into the approximate spot and continues gaily on his way, making like merry-go-rounds with the dummy and if the dummy should happen to be at all sturdy, bending both his bayonet and rifle barrel. The instructor is so interested in seeing that the G.I's blood-curdling screams will properly terrify the enemy, as typified by the dummy, that he neglects to mention the little matter of withdrawing the bayonet in the line of thrust and the pile of rusting useless bent barrels grows higher than the armourer's blood pressure. No fellows—a bent barrel cannot be straightened to shoot accurately ever again—not even at the factory where they are made.

Remember all you G.I's who read this, and pass it along to the poor unfortunates who don't, always withdraw the bayonet in line with the direction of thrust; and all you, entrusted with the job of manufacturing bayonet dummies, make them of faggets or sandbags or anything but solid blocks of wood or such like.



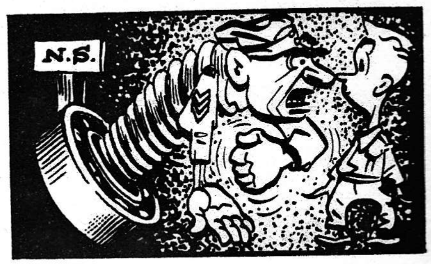
Typical example of a barrel off the beam—and a total loss.

SAVING BEARINGS

CAN you spare about a nickels worth of time to learn how you can save a few thousand dollars worth of bearings? Sure you can—so here's the whole sad story.

Ever since the war started there has been a severe shortage of bearings for civilian use. Fortunately for us, the manufacturers have been able to supply the demands of the Army, both at home and overseas. So far so good or perhaps we should say—not so good.

Because we were able to get new bearings just about any old time we felt like it, we got into a rut. We threw away scads of bearings that still had lots of wear in them. Came the invasion——bingo——bearings are now scarce as hair on the well known eight ball. You see the boys over in France need bearings—lots of them, and they come first.



Just to show you how careless some of us have been in the past here's what we found. Seventy-five ball bearings were picked up in a certain district and brought to N.D.H.Q. for an experiment. They were then sent to a reconditioning plant to be reground and fitted with oversize balls. In due course forty of the seventy-five bearings were returned to N.D.H.Q. with a note saying there was nothing wrong with them that a good cleaning in Varsol wouldn't fix.

If you haven't been worrying about bearings in the past — start now. Don't throw a bearing out till you're positive it's shot—positive deep down in your thrifty, frugal, tight-fisted conscience.

X Y Z

Putting a STOP to Vehicles

WHEN you put your foot down you may think that's the end of it.

From a maintenance angle it's only the beginning.

There are several methods of stopping a vehicle—including dragging your feet or just pointing the radiator at a brick wall. But, thanks to the guy that invented brakes all we have to do is relax and push our foot down on a pedal. What happens when we push the pedal, of course, depends on how much the Joe knew who did the last brake job. If he was on the bit and knew his stuff you whoa-up smooth and slick. From this you can see that it's important for Joe to know his stuff.

Not that there's anything mysterious about brakes. They all follow definite principles of leverage and friction that are applied either by a mechanical, hydraulic or air power system.

You apply your tootsy twelves to the brake pedal and by one of the various systems your trucks' brake shoes are pressed against the drums in the wheels (Fig. 1) and the resulting friction slows the wheels. You, your foot, and the rest of the vehicle, being attached to the wheels naturally slow down also. When you stop to think of the weight of your truck as compared to the weight of your foot—you've got an idea of the amount of work your braking system does for you—and a good reason why everything has to be in top notch condition to do the job. To get them that way calls for plain everyday care, knowledge and correct use of the proper tools everytime you break open the brakes. Maybe yours' or your buddys' life may depend on it.

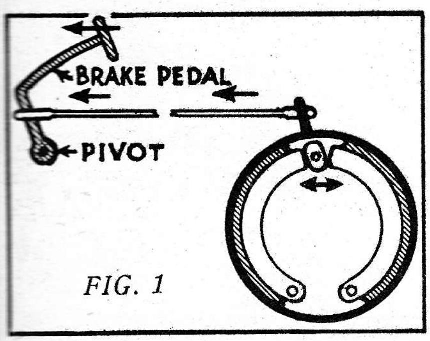


FIG. 1

What goes on between the brake pedal and the brake shoes on most Army Vehicles is a study in hydraulics. A simple subject. If you know enough to figure out what makes a water pistol squirt you're well on the way to understanding a hydraulic braking system.

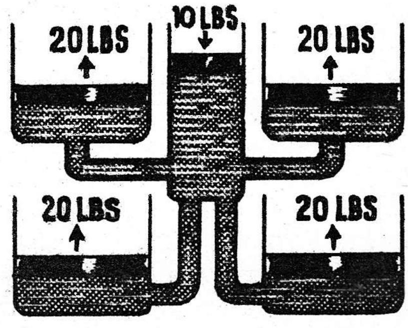
Fig. 2 shows a master cylinder and four other cylinders (which could represent the ones in the wheels) all partially filled with a liquid and equipped with a piston. The master cylinder is only half the diameter of the others but is longer—for reasons to be explained.

If we force the master cylinder's piston down with a pressure of ten pounds per square inch we'll force all the other pistons up at 20 pounds per square inch (just twice as much pressure). You can see how we gain a mechanical advantage by having the other cylinders twice the diameter of the master cylinder. We never get anything free tho' and in this case the master cylinder piston would have to move eight times as far as each of the other cylinder pistons.

If we used a system where all cylinders were the same size the pressure on the other four cylinders would be exactly the same as the pressure applied to the master cylinder but because there are **four** places for the fluid to go—the master cylinder piston would move **four** times as far as each of the others.

The secret of a hydraulic systems' success is the old rule that a **liquid won't compress**. However, air will compress, as we all know, so if by chance we have air in the line the master cylinder's piston could move without causing any movement of the

Fig. 2—You go a bit further to do less work.



other pistons due to the spring-like action of the air bubble (Fig. 3). That's why air in hydraulic systems causes that spongy feeling at the pedal and that prickly feeling in the back of the neck when the brakes don't respond with the required stopping ability.

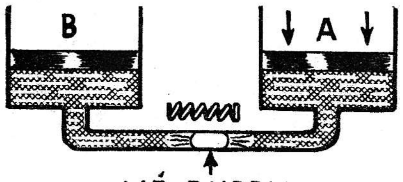


Fig. 3—That air bubble works like a spring in Mabel's chesterfield. It's a waste of time using energy to compress the spring—or the air bubble.

From this point it's not much of a jump to apply our system of pistons and cylinders to a foot pedal and a set of brake shoes as in Fig. 4. The pistons moving outwards in the brake cylinders take the place of the cam in the mechanically operated type.

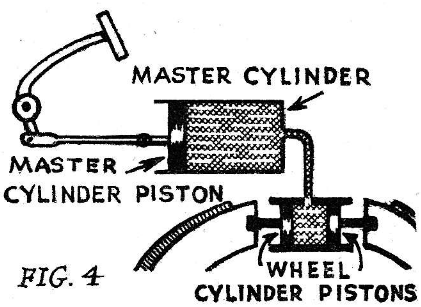


FIG. 4

We don't want to pull the wool over your eyes by telling you the simple systems that we have shown will work in practice because they won't—some refining must be done and here's why. Whether the brakes are "on" or "off" we have to keep the entire system full of fluid—we already mentioned the result of air in the line. For this reason you'll need to know more of what actually happens inside the master cylinder—a quick glance at Fig. 5 will help explain.

The piston has two rubber cups to provide a good seal when the brakes are applied. One of them (known as the primary cup) is not attached to the piston. The secondary cup is. Note the position of the two bleeder holes between the cylinder and the reservoir. As the brakes are applied the piston moves ahead and bleeder hole "A" is covered by the primary cup so the fluid won't be forced into the reservoir. The farther the piston travels ahead the more pressure is exerted at the wheel cylinders.

Now let's release the brakes and see what happens. When the brakes are released the master cylinder piston is forced back by the return spring (you'll notice it in Fig. 5). The wheel cylinder pistons don't return as fast as the master cylinder piston so a partial vacuum would be formed ahead of the primary cup if it weren't for the vents (at B and C). As the piston returns to the released position fluid flows through vent "B", through vents "C" past the rubber primary cup and fills the space ahead of the piston.

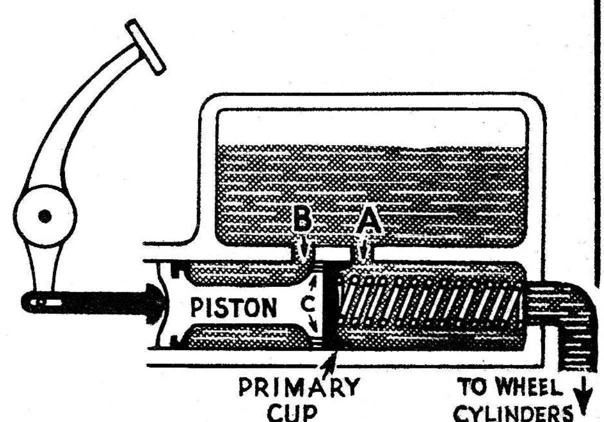
But—as the **wheel** cylinder pistons lag behind and slowly come back to the release positions we would have too much fluid in the system and our brakes wouldn't fully release if it wasn't for the vent hole—or compensating port as it is called, at "A". By this time the master cylinder piston and primary cup have been forced all the way back by the return spring. As the wheel cylinders release they force the excess fluid through the hole at "A" and back into the reservoir. The brakes are then fully released.

It may take a couple of minutes to get this tricky arrangement well rooted under your hat, but it's worth it. The job of curing the ailments that occasionally occur will be that much easier.

Knowing about that little compensating port at A (Fig. 5), for example, will probably solve the problem when the brakes won't release. That little hole is just clear of the primary cup when it's in the fully released position—for the good reason that the slightest movement of the piston, when you apply the brakes, will close it and force the liquid into the lines and not into the reservoir.

But if the rubber primary cup becomes swollen or rotted it may cover or plug this hole even when in the fully released position—thus preventing the liquid flowing back into the reservoir and so holding a pressure on the wheel cylinders. This state of affairs happens often enough to cause the occasional sight of a bewildered Joe kicking at the brake pedals, wheels and radiator of his apparently permanently parked vehicle, in the optomistic hope that it will somehow mysteriously fix itself.

Fig. 5—The neat and simple arrangement of the ports A, B and C are the secret of the master cylinder's success. The primary cup is free from the piston to allow the fluid to bleed through at C.



You and I know he hasn't a hope with a swollen or disintegrating primary cup in the master cylinder.

Rubber cups don't swell up and cause trouble on their own hook. There's a reason—sometimes it's to be found right in the fluid. The fluid used in hydraulic systems is very special stuff—special in that it won't do a lot of things. It won't evaporate in summer, it won't get thick in cold weather, and it won't cause damage to the rubber cups or make hair grow on your chest or in the lines. All these characteristics were laboriously developed and built into this fluid by a flock of smart chemists and engineers.

They can't stop some Joe from being careless and getting dirt into the system tho'—or handling the rubber cups with greasy or oily fingers—or worse yet, cleaning the internal parts with varsol or gasoline, all sure ways of causing plenty of trouble. All they can do is say—loud and often—keep everything absolutely clean and use clear wood alcohol for cleaning. If wood alcohol isn't available use the next best—denatured alcohol or clean brake fluid.

Another common symptom of trouble is a spongy action of the pedal. A couple of things can cause this but it's most likely traceable to air in the line—like we showed in Fig. 3. The cure is to get the air out—by a process known as "bleeding". What it actually amounts to is draining the fluid with the air bubbles in it out—without getting dirt, flys or more air in. There's a few things to watch when doing this to make sure that this doesn't happen.

First thing to do when bleeding the brakes is carefully clean off all the bleeder connections at the four wheel cylinders and around the master cylinder plug. While the lines are being bled the master cylinder should be **at least** half full of fluid. If you have an automatic filler handy you're lucky because this will automatically look after the fluid level in the master cylinder. If you have to do it by hand—fill the master cylinder to the **lower edge** of the filler neck before you start the bleeding business—then keep your eyes on the level. Never use old or reclaimed fluid—it might be contaminated with dirt, traces of oil, grease or stale beer.

The longest pipe line of the brake system should be bled first, then the next longest and so on. The proper sequence for each make of vehicle is shown in the vehicle's manual. Get into a huddle with it before you start.

From then on it's straight routine. Attach the bleeder hose and fixture to the wheel cylinder bleeder screw and place the end of the tube in a glass jar (end of tube submerged in fluid). Open the bleeder valve about 3/4 turn.

Now have your number one boy depress the foot pedal by hand allowing it to return very slowly. This pumps the fluid through the line and out the bleeder hose along with any air that happens to be in the line. When bubbles stop appearing at the end of the hose, tighten the bleeder valve, remove the hose and hop to it with the next longest line.

After all the wheel cylinders have been done in this manner make sure that the master cylinder is filled and the filler plug replaced.

Don't use the fluid you have just drained out of the system. This is one of those occasions where nobody will thank you for "making the old stuff do".

Tho' necessarily brief and simple, the above all goes to show that what can happen when you tread on the brake pedal can be good or bad—make sure that what happens to you is good.

X Y Z

We didn't say that—but. The hand-writing on the wall indicates one of these days you may be hanging onto the handle end of a crank—trying to wind up your 6 x 6. All we can say is—that's a hell of a way to keep warm on a cold wintry morning. Of course there's a way out. You could keep your battery in the pink of condition so it will last twice as long. Right now the powers that be tell us the battery situation is "critical". We happen to know they're not kidding.

With colder weather right at our doorstep the wear and tear on batteries is going to increase. This makes it all the more important to give them extra special care. You know without us telling you all the extra work the battery has to do in the winter time. Harder starting on cold mornings—The lights are being used more often—you may even be lucky enough to have a heater. All these things add up to one thing, give your old battery a break, treat it like it's the last one you'll ever get. Here's how.

Keep it fully charged at all times. Keep the level of the electrolyte ⅜" above the plates. Check it every morning. If you ever find the B. run down, have it recharged in the shop toot sweet, don't operate it in the vehicle when it's below 1.225 s.g.

Battery shops are equipped to completely rebuild batteries so if you think your battery is worn out don't make it any worse, don't put a hammer to it.

Be a crank on battery care—don't be on the end of a crank because you didn't care.

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HOW TO USE THE INDEX

The index is broken down into six main groups, "B" Vehicles, "A" Vehicles, Motorcycles, Telecommunications, Armaments and General.

All the subjects large and small that have appeared in CAM from Oct. 1943 to Sept. 1944 are listed alphabetically. CAM page numbers start with "1" at the beginning of the publication year and run consecutively through the twelve issues to page "220"

Covers are listed like this:

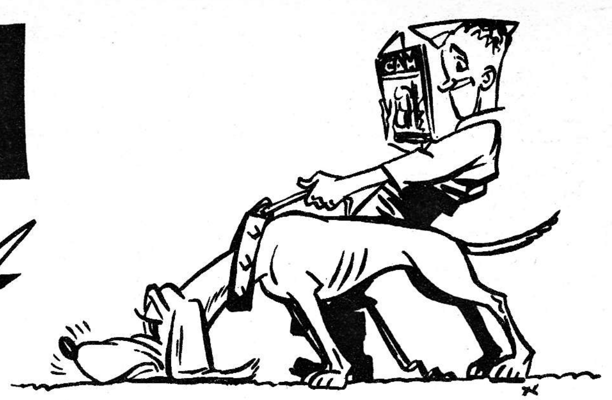
IF—Inside Front—Cover
IB—Inside Back—Cover
OB—Outside Back—Cover

The number following "B" or "F" indicates the issue—for example OB12 means "Outside Back Cover, twelfth issue.

"B" VEHICLES

TO CAM

Oct. 1943 to Sept. 1944



No, he didn't get that way from reading the article on valves in this issue.

He was doing some private research on a SODIUM FILLED VALVE he found laying around the shop.

WHAM!!

Now this isn't meant to throw a scare into anybody, because when these valves are in the engine they go about their work and are cooled by the sodium in a perfectly harmless and peaceable manner.

The sodium in them melts at engine operating temperature and as the temperature increases the liquid turns to a high pressure gas. If you try to melt these stems down the gas will explode out of the weakened shell. Water on sodium makes it give off hydrogen—which is as explosive as T.N.T. So don't cut them open near water. Better still—don't cut them open.

If you carelessly dispose of sodium filled valves they may get into a furnace with other scrap and blow it apart. Be suspicious of any exhaust valves with a stem diameter more than 3/8" whether they have a plug in the end or not.

Bury them deep in the ground.